

2.3

Complementary and Supplementary Angles

Goal Find measures of complementary and supplementary angles.

VOCABULARY

Complementary angles Two angles are complementary angles if the sum of their measures is 90° .

Complement The sum of the measures of an angle and its complement is 90° .

Supplementary angles Two angles are supplementary angles if the sum of their measures is 180° .

Supplement The sum of the measures of an angle and its supplement is 180° .

Adjacent angles Two angles are adjacent angles if they share a common vertex and side, but have no common interior points.

Theorem A theorem is a true statement that follows from other true statements.

Follow-Up Think of a way to help you remember the meaning of each term.

Complementary angles

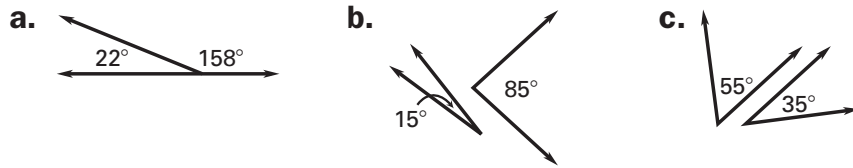
Answers will vary.

Supplementary angles

Answers will vary.

Example 1 *Identify Angles*

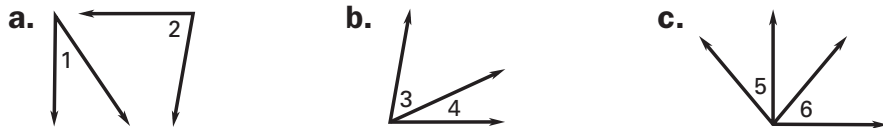
State whether the angles are *complementary*, *supplementary*, or *neither*.

**Solution**

- a. Because $22^\circ + 158^\circ = 180^\circ$, the angles are supplementary.
- b. Because $15^\circ + 85^\circ = 100^\circ$, the angles are neither.
- c. Because $55^\circ + 35^\circ = 90^\circ$, the angles are complementary.

Example 2 *Identify Adjacent Angles*

State whether the numbered angles are *adjacent* or *nonadjacent*.

**Solution**

- a. Because the angles do not share a common vertex or side, $\angle 1$ and $\angle 2$ are nonadjacent.
- b. Because the angles share a common vertex and side, $\angle 3$ and $\angle 4$ are adjacent.
- c. Although $\angle 5$ and $\angle 6$ share a common vertex, they do not share a common side. Therefore, $\angle 5$ and $\angle 6$ are nonadjacent.

Example 3**Complements and Supplements**

- a. $\angle A$ is a complement of $\angle C$, and $m\angle A = 47^\circ$. Find $m\angle C$.
- b. $\angle P$ is a supplement of $\angle R$, and $m\angle R = 36^\circ$. Find $m\angle P$.

Solution

- a. $\angle A$ and $\angle C$ are complements, so $m\angle A + m\angle C = 90^\circ$.

$$47^\circ + m\angle C = 90^\circ \quad \text{Substitute for } m\angle A.$$

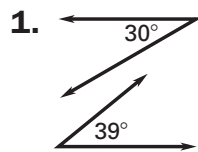
$$m\angle C = 43^\circ \quad \text{Solve for } m\angle C.$$

- b. $\angle P$ and $\angle R$ are supplements, so $m\angle P + m\angle R = 180^\circ$.

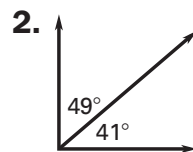
$$m\angle P + 36^\circ = 180^\circ \quad \text{Substitute for } m\angle R.$$

$$m\angle P = 144^\circ \quad \text{Solve for } m\angle P.$$

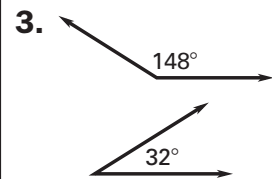
✓ **Checkpoint** State whether the angles are *complementary*, *supplementary*, or *neither*.



neither



complementary



supplementary

4. $\angle B$ is a complement of $\angle D$, and $m\angle D = 79^\circ$. Find $m\angle B$.

11°

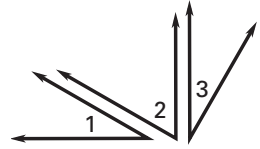
5. $\angle G$ is a supplement of $\angle H$, and $m\angle G = 115^\circ$. Find $m\angle H$.

65°

THEOREM 2.1: CONGRUENT COMPLEMENTS THEOREM

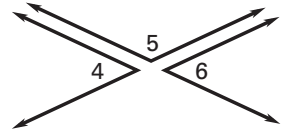
Words If two angles are complementary to the same angle, then they are congruent.

Symbols If $m\angle 1 + m\angle 2 = 90^\circ$ and $m\angle 2 + m\angle 3 = 90^\circ$, then $\angle \underline{1} \cong \angle \underline{3}$.

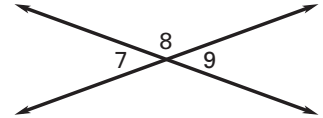
**THEOREM 2.2: CONGRUENT SUPPLEMENTS THEOREM**

Words If two angles are supplementary to the same angle, then they are congruent.

Symbols If $m\angle 4 + m\angle 5 = 180^\circ$ and $m\angle 5 + m\angle 6 = 180^\circ$, then $\angle \underline{4} \cong \angle \underline{6}$.

**Example 4 Use a Theorem**

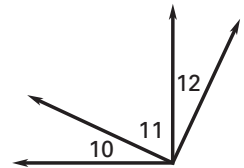
$\angle 7$ and $\angle 8$ are supplementary, and $\angle 8$ and $\angle 9$ are supplementary. Name a pair of congruent angles. Explain your reasoning.

**Solution**

$\angle 7$ and $\angle 9$ are both supplementary to $\angle 8$. So, from the Congruent Supplements Theorem, it is true that $\angle \underline{7} \cong \angle \underline{9}$.

✓ Checkpoint Complete the following exercise.

6. In the diagram, $m\angle 10 + m\angle 11 = 90^\circ$, and $m\angle 11 + m\angle 12 = 90^\circ$. Name a pair of congruent angles. Explain your reasoning.



$\angle 10$ and $\angle 12$; $\angle 10$ and $\angle 12$ are both complementary to $\angle 11$. So, from the Congruent Complements Theorem, it is true that $\angle 10 \cong \angle 12$.